Platform Markets: Their Place in the Theory of Mesoeconomic System: Development and a Challenge to Spatial Studies

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PLATFORM MARKETS: THEIR PLACE IN THE THEORY OF MESOECONOMIC SYSTEM: DEVELOPMENT AND A CHALLENGE TO SPATIAL STUDIES

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Over the past three decades, researchers across different disciplines have paid close attention to the development of platform markets — an emergent long-term trend in economic policy. I consider platform markets as institutional and technological systems. Platforms create systems of rules and mechanisms that stimulate agents to adopt, maintain, and improve standards disseminated by the most successful platforms. Similarly to economic zones and clusters, platform markets are two-factor mesoeconomic systems. In this article, I consider the differences between two-factor systems and traditional one-factor groupings (agglomerations, industries, and conglomerates). I present a general theoretical framework for studying two-factor mesoeconomic systems, which is employed in a comparative analysis. A specific feature of platforms is the contribution of digital technology to the formalisation of relevant external effects and institutions, whereas economic zones are characterised by the external effects of agglomeration and clusters — by locally specific effects. Platforms are replacing economic zoning and clustering on the research agenda.

Keywords: platform, platform markets, platform economy, network effects, cluster, conglomerate, local economic zone, mesoeconomic system, agglomeration, spatial economics

Introduction

Global platform economy is experiencing an unprecedented growth [1]. Since its influence is felt across almost all areas of theory and practice, platform economy has become a major challenge for spatial research [2], so much so that any spatial theory proposed today should be tested for compatibility with the observed platform economy phenomena [3—6].

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One elegant economic theory of platform markets — multisided platforms — emerged much earlier than platforms received wide attention. This, modelling platforms requires few concepts that are truly new. Approaches used within game theory, NIE, and industrial organisation suffice to describe platform markets, also known as *two-sided markets* [7].

However, the effects of deeper-level global technological platforms (the Internet and cyber-physical systems) and the dialectic of platform market development translate into the emergence of new qualitative effects, which apparently have not been foreseen by the macroeconomic theory. One of such emerging effects is the rise of socioeconomic big data, which has provided a solution to the ever-present problem of economic science, i. e. that of determining and forecasting preferences.

Since platform markets strongly affect economic development, this study aims to analyse the features of platforms as institutional and technological systems and to compare them with other known and common types of mesoeconomic systems.

The first part of this article will focus on the phenomenon of platform market development. I will describe network effects at the heart of platform markets, demonstrate the connection between platforms and institutions, and identify a number of what I believe to be new institutional properties of platform markets. The second part of this article will compare platform markets with other types of mesoeconomic systems[1] — clusters and local economic zones — using tailor-made criteria. In conclusion, I will emphasise that, from the perspective of the theory of mesoeconomic system development, *platform markets* are an important empirical and theoretical model that complements and completes the typology of two-factor mesoeconomic systems.

The theory and practice of platform market functioning

This study will distinguish between platform markets, technological, and digital platforms. Figure shows how the three interrelate.

There is a vast body of national and international research on the theory of two-sided and multi-sided platform markets (see, for instance, [9—11]). Thus, I will only make a few remarks on the key characteristics of these phenomena.

[1] Mesoeconomic systems are described as groupings of heterogeneous economic agents (as a rule, firms and their environments) [8]. Studies into such groupings traditionally faced the problem of institutional formalisation and that of the identification of external effects creating weak ties within mesoeconomic systems. Digital formalisation of institutions provides a new perspective on many of the issues tackled by social science scholars.

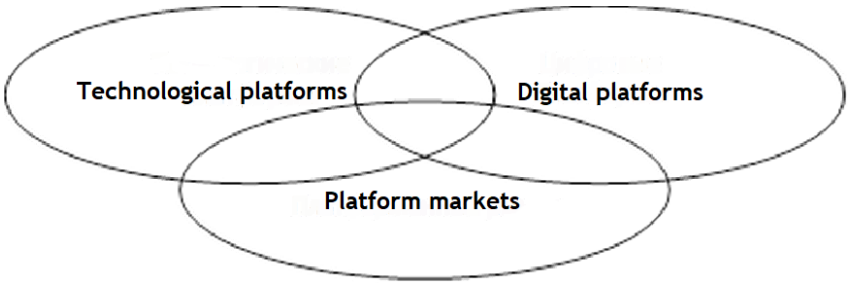

Fig. Technological platforms, digital platforms, and platform markets concept overlap

Few researchers disagree that two-sided markets are products of network effects between two interconnected markets whose agents use a platform to interact. The key distinguishing feature of a platform is that the operator sets prices for access for all the agents, i. e. the platform's clients.

There are different approaches to platform formalisation — those at the level of the platform's markets (1), at the level of the platform's agents (2), and at the level of competition between different platforms (3). All of them describe the strategic situation and the external effects of (not) joining a group.

1. In its traditional form, the theoretical game model of a two-sided market comprises two interdependent functions of demand for participation in the platform [12]:

$$q_A = D_A(p_A, q_B), \quad q_B = D_B(p_B, q_A), \tag{1}$$

where q_r is the number of agents connected to the platform for markets A and B.

Direct dependence between the parameters q_A and q_B in both demand functions is an important element of this model. Platform operators control the prices p_A and p_B. A price increase in any of the markets results in a network effect, which leads to platform shrinkage. A decrease in the prices entails a cumulative effect of the expansion of both markets. Platform expansion is limited by the size of agent population. Therefore, the process of connecting to the platform can follow an S-curve. Such development pattern is characteristic of both technological and institutional factors that affect the process in question.

2. At the level of agents, network effects produce the following theoretical game model:

$$u_i = x_i n - p, \tag{2}$$

where u_i stands for the net utility of the i^{th} agent, p for the amount charged by the operator for the platform use, x_i for the individual assessment

of the th agent's willingness to participate in the platform (readiness to pay), and *n* for the function that increases as the number of agents connected to the platform grows.

If the impact of *n* is excluded, game equilibrium is determined exclusively by the distribution of individual assessments x_i. In more complicated cases, population is divided into groups by an agent for whom connection to the platform is irrelevant. For such an agent, $u_i = 0$. Thus, $p = x_i n$. While generally there are several equilibria in such games, not all of them are stable.

3. Platform network effects can also be modelled at the level of competition between platforms. For instance, [13] employs the following model of oligopoly in the market of search service providers:

$$\pi_i = \frac{z_i}{\Sigma_i z_i} \upsilon - \frac{z_i}{N_i} - F, \quad (3)$$

where z_i stands for the quality of the i^{th} search engine (the quality of the search service provided by the platform), N_i is accumulated search *history*, which affects the cost of quality production (the greater the number of queries, the higher the quality), υ is advertising revenue, directly proportional to the number of queries processed by the platform (or its market share), and *F* is fixed costs (investment in the platform creation). Network effects are closely linked to the impact of the variable N_i. Note that this model describes a strategic situation, and whether the platform wins depends on the quality of other competing platforms, z_{-i}.

Looking at the models shows how different approaches to interpreting and modelling network effects are (for more detail, see [14]). While this variety provides a solid theoretical framework for the concept of platform markets, it accounts for the diversity of platform definitions and platform types identified in theory and, especially, in practice. Here it is important to understand the general principles behind the functioning of platform markets, especially, digital ones. A more detailed review of different platform market typologies and of practical cases can be found in many works (see, for instance, [12; 15]).

Two key elements of platforms — technologies and institutions — are easily identified from their digital footprint. The major factors are the critical mass of agents using the platform, i. e. the technological and institutional rate of expansion, agents' reputations, and — most importantly — the proportion of member agents in the population. Naturally, attention of general public is drawn to platforms of a potential national and (or) global scope.

To a great extent, the theory of platform development is a generalisation of models describing competition between technological standards. Like platform competition, standard competition has been studied since the dawn of the digital era [16; 17]. Later sources of authority considered

platforms as an independent module of the general intermediation theory [14]. A qualitative and profound shift in the understanding of platform economy occurred with the spread of wireless network standards and mobile electronic devices. However, the expansion of industrial platforms — mainly those related to additive manufacturing and full product lifecycle management — is of greater importance for meoseconomic production systems.

Platform markets present a serious challenge to regional and spatial studies [18], and the authors of the anniversary review for the *Regional Studies* journal emphasised inconsistencies and uncertainties in the current regional studies agenda. This is largely explained by the platform-based spread of technology and institutions. Some authors also speak of 'virtual geographies' [2]. I believe that the very notion of technological leadership is moving from cluster model towards that of dominant platforms, which consider not only production capabilities but also cohesion between agents using different production and sales platforms and integrating customers into their platforms.

Although platforms have a rather weak connection to traditional geographical space, the positioning of largest global platform operators' headquarters still follows the traditional principles of agglomeration and concentration around global cities and established centres of technology [4, p. 12].

Regional development is increasingly affected by complex flows of information and finances, whose sources and transmitters are not only large multinational corporations but also diverse economic groups of agents consisting of small and medium-sized companies brought together by a platform [1].

Platform markets in the mesoeconomic system typology

In a broad sense, mesoeconomics studies the evolution of economic groups and thus it is affected by sectoral, spatial, and institutional economics. Note that mesoeconomics is not a subsidiary discipline, like micro- and macroeconomics [19]. Mesoeconomics is an interdisciplinary area that studies diverse groups of economic agents — groups emerging in the competition between generic rules adopted by such agents [8]. This area deals not only with competition between agents but also with competition between, and the evolution of, groups.

Studies of groups are complicated by the need to consider at least two levels of the system — the level of individual microeconomic agents and that of their associations. Competition between groups depends on the viability of grouping rules[2].

[2] This process reminds of evolutionary biology and of the emergence of ideas about the role of two-tier systems of evolution (the traditional species — organism system or the carrier — replicator opposition at a different conceptual level) [20].

As the views on key factors determining competitiveness evolve, the idea of what group objects should be studied by researchers and practitioners is changing.

Traditionally, it was believed that the main factors influencing socio-economic evolution and competitiveness were location and technology. A more recent view introduces the concept of institutions as a new factor affecting competitiveness. Thus, contemporary approach to mesoeconomic system studies gives equal value to three consolidated factors — location, technology, and institutions.

As shown in Table 1, one can distinguish between two large categories in the typology of mesoeconomic systems, depending on the number of actors used to identify these categories.[3]

Table 1

Key development factors and relevant types of mesoeconomic systems

System	Factor group		
	Location (space)	Technology	Institutions
Agglomeration	+		
Sector		+	
Conglomerate			+
Zone	+		+
Complex/**cluster**	+	+	
Platform		+	+

Source: compiled by the author.

One-factor systems are agglomerations, sectors, and conglomerates.

Two-factor systems are of special interest: as one can see, platform markets are important elements in the typology of mesoeconomic systems.

Economic zones are the most obvious institutional-spatial systems (second to sectors, which are studied within industrial organisation). Zones develop under the influence of exogenous regulatory institutions that distort initial incentives.

[3] Networks are not included in the typology, since network analysis is considered as a universal means (language) to describe a system (integrated objects consisting of elements and connections between them). In this sense, any mesoeconomic system can be modelled as a network. It is also possible to study relevant network effects. (For more detail on the network structure of economy, see [21]).

Cluster is the focus of spatial studies. In my earlier works, I considered the differences between cluster and complex models [22] and the role of institutions with the cluster approach [23]. I largely agree that endogenous location-specific institutions are key to the formation of clusters However, these institutions are poorly formalised and lack tangibility, which makes this factor inferior to location and technology. Thus, I define clusters/complexes as primarily spatial and technological systems, with a weak institutional factor being a distinguishing characteristic of clusters.

Platforms are institutional-technological systems, within which it is possible to identify (or formalise) both a technological and an institutional component. The latter is of greater importance, since platform-based formalisation of institutions is happening at an unprecedented rate.

Whether three-factor systems are possible is an open question. For a long time, clusters were thought to be such systems. However, they lack pronounced institutional characteristics, which are present in conglomerates, zones, and platform markets. The prototypes of such systems are smart cities.

Early attempts to derive a theory of inter-firm groups from such an understanding of the role of institutions did not make it possible to 'capture' the institutions themselves. Similarly, pre-digital two-sided markets did not give the whole picture of the scale and rate at which global digital platforms were developing. Digitising is not a *sine qua non* for the emergence of platforms but it is a necessary tool for the formalisation of the platform functioning rules and an efficient use of the transaction history.

Thus, there are two key elements attributed to the competitive advantages of digital platform markets:

1) Platforms make it possible to formalise institutions digitally. Platforms have memory and can store the history of transactions (interactions between users).

2) Platforms can derive information about producers and consumers, which translates into a more efficient use of resources.

Within platforms, information technology has solidified the features crucial for the evolution of institutions, i. e. the accessibility of the whole agent population and the capacity to store the history of both economic and social transactions.[4] The way information technology affects the determination of preferences deserves a special study. In their research on psychometrics, M. Kosinski et al. have shown that identification of consumer preferences and modelling of choices can employ a machine learning-based consumer classification [24].

[4] Interestingly, emerging digital platform-based entities are embracing terminology developed within institutions studies (consensus management, smart contracts, transaction management, voting models, etc.).

These characteristics — established rules (for instance, those for joining a platform), stable game equilibria, and direct and indirect rule enforcement mechanisms — reveal the institutional nature of platforms. In case of a violation, an agent can be banished from the platform. At the same time, contract formalisation makes such violations next to impossible, since many platforms computerise transactions and contract relations, which are controlled by a program code.

Joining a new platform should be beneficial for an individual [3]. Having joined a platform, individuals do not have any incentive to disregard its rules because platform users grow accustomed to its routines. The history of agents' reputation (the quality of their products and services) is being built in the framework of a platform. Such histories have independent value and contribute to the emergence of new markets that are based on information and data dissemination.

A comparison of two-factor mesoeconomic systems

The theoretical framework presented in Table 1 helps to develop a comprehensive picture of the evolution of two-factor systems — zones, clusters, and platforms.

Table 2 offers a comparative analysis of such systems, which is based on tailor-made criteria pertaining to the system's theoretical framework and contribution to regulatory interactions. Two-factor mesoeconomic systems have become the major object of study within the current industrial policy. This is explained by a recent shift from individual and sectoral support instruments to those supporting groups.

Table 2

Competitive characteristics of two-factor mesoeconomic system development

Characteristic	Zone	Cluster	Platform
Generic term	Regulation, concessions	One-sided markets, competition	Two-sided markets, standards
Boundaries	Precise, accurate to an agent or a location	Fuzzy	Precise, accurate to a transaction
An established economic framework	None; influenced by the regulation theory	None; influenced by the input-output theory	Present; two-sided market (platform) theory
Grounds for theoretical feasibility	The possibility of pricing arbitration, tax recovery	Probably, (agglomeration) externalities	Network externalities (indirect)

End of table 2

Characteristic	Zone	Cluster	Platform
Identification method	Deduction	Induction	Induction / Deduction
Negative factors	An institutional trap, should concessions be abolished	An institutional trap, should competitive positions be lost	A tendency towards monopolisation and inequality
Restrictive policy potential	High; at the level of statutory instruments	Restrictions are not advisable	Limited; at the level of prohibition and control
The role of public support	Central	Not proven	Not apparent
The role of the state in the launch 'from scratch'	Central — statutory mechanisms and investment in infrastructure	Indirect — infrastructure and statutory instruments	Public-private platforms within a single jurisdiction are possible
Influence on the stakeholders' home region	Considerable, partly because of incentive distortion	Considerable and positive	Not proven, probably, positive

Source: compiled by the author.

In my opinion, platforms were the missing element in the typology. Having emerged within industrial organisation, they surpassed the limits of the theory that focuses mainly on pricing decisions and anti-monopoly practices [17].

The most successful platforms have turned into global mesoeconomic systems that affect the macroeconomic performance of not only individual regions but also that of the global economy. Some studies attribute global deceleration of inflation to the expansion of digital e-commerce platforms (i. e. the reduction in the transaction costs of the search for the best deals) [25].

Although the major platforms studied specialise in the modernisation of service industries, the basis for industrial modernisation is formed by the industrial Internet of Things platforms (innovative platforms, according to Evans and Gawer's classification [4]). These bring together producers and developers of engineering design systems. New platforms' technology makes it possible to combine engineering and physical models and create digital twins of actual systems and products at all lifecycle stages [26]. Such platforms provide for more flexible small-batch production and bring manufacturing closer to the consumer [1]. In the future, they will erode cluster model of industrial organisation even further.

Conclusions

Many theories of economic system development based on sectoral and spatial concepts were rather limited due to the weakness of institutional factors. The expansion of global platform markets brings in an important link — institutional technological systems that are independent of a concrete location but have powerful mechanisms for the formalisation of rules and standards.

Platform markets empowered by information and new production technology have everything for the formalisation and functioning of institutional mechanisms. Moreover, platform markets determine preferences and store transactions histories. Platforms formulate systems of rules and mechanisms that encourage agents to accept, support, and develop the rules and technology standards.

A by-product of platform emergence is the industry of socioeconomic big data that is owned by platform operators. This poses a serious methodological problem for traditional socioeconomic research methods (geographical and statistical measurements, surveys, etc.), since big data is undermining the value of such methods.

The development of information technology made platform markets a phenomenon of global consequence [1]. Their presence is so formidable that they affect the actual public policies across many regions and countries [6]. I believe that platform markets will gradually replace cluster approach. In effect, platform markets differ from clusters quite substantially.

1) Platforms have a developed theoretical framework and they are identified more easily than clusters.

2) Platforms make it possible to formalise institutions digitally. They have institutional memory and can store the whole history of transactions (interactions between users).

3) Platforms can derive information on producers and consumers, thus making the use of resources more efficient.

4) Platforms contribute to the tendency towards monopolisation and inequality.

5) States can take an active part in platform regulation (and create public-private platforms).

The effect that platform markets will have on spatial economics and location of production is still unclear, and the most urgent research problems pertain to the three aspects of platform market functioning. These are:

1) Spatial consequences of platform development; formation of three-factor economic systems where location, technology, and institutions are of equal importance;

2) Consequences of the global dominance of industrial platforms for traditional clusters; an analysis of the consequences of computerisation, additive technology, and the dwindling the role of narrow local labour markets (the role of the human in production);

3) Changes in the public policy on the platform economy; studies into how public policy can and should contribute to the development of emerging and established platforms.

It is likely that the role of economic zoning and clustering will reduce and that the cluster approach employed at the local level and the global development of platform technology will escalate competition at the level of advanced agglomerations (today, they are referred to as *smart cities*). A more complete substantiation of, or revisions to, this hypothesis will require a larger body of observations and a more developed conceptual and analytical framework.

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